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United States Patent [19]**Davis**[11] **Patent Number:** **5,120,958**[45] **Date of Patent:** **Jun. 9, 1992**[54] **ION STORAGE DEVICE**[75] **Inventor:** **Stephen C. Davis**, Fen Ditton,
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Manchester, England[21] **Appl. No.:** **696,789**[22] **Filed:** **May 7, 1991**[30] **Foreign Application Priority Data**

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[51] **Int. Cl.⁵** **H01J 49/40**[52] **U.S. Cl.** **250/292; 250/281;**
250/282; 250/283; 250/286; 250/287[58] **Field of Search** 250/292, 287, 281, 282,
250/283, 286[56] **References Cited****U.S. PATENT DOCUMENTS**

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Primary Examiner—Jack I. Berman*Assistant Examiner*—Kiet T. Nguyen*Attorney, Agent, or Firm*—Leydig, Voit & Mayer[57] **ABSTRACT**

An ion-storage device has an electrode structure for subjecting ions in a defined region along a path P to an electrostatic retarding field.

The electrostatic retarding field is in the form of an electrostatic quadrupole field. Ions enter the defined region at a position P₁ on the path and they exit the defined region at a position P₂, having travelled a distance x_T. Ions are subjected to the electrostatic retarding field during an initial part only of a preset time interval and the velocity of each ion during that part of the preset time interval is related linearly to its separation x from the exit position P₂ by the expression,

$$v = k \left(\frac{q}{m} \right)^{\frac{1}{2}} \left(\frac{x}{x_T} \right)$$

where m is the mass of the ion, q is its charge and k is a constant.

Ions having the same mass-to-charge ratio (m/q) all exit the field region at the same time during the remaining part of the preset time interval.

17 Claims, 3 Drawing Sheets